B O N N E V I L L E   P O W E R   A D M I N I S T R A T I O N

Wind River Watershed Restoration Project

Underwood Conservation District

Annual Report 2003 - 2004 | December 2004 | DOE/BP-00005480-2

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Wind River Watershed Restoration

2003-2004 Annual Report
for the period July 1 2003 to June 30 2004

December 2004

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Table of Contents

Introduction

The goal of the Wind River project is to preserve, protect and restore Wind River steelhead. In March, 1998, the National Marine Fisheries Service listed the steelhead of the lower Columbia as "threatened" under the Endangered Species Act. In 1997, the Washington Department of Fish and Wildlife rated the status of the Wind River summer run steelhead as critical. Due to the status of this stock, the Wind River summer steelhead have the highest priority for recovery and restoration in the state of Washington's Lower Columbia Steelhead Conservation Initiative.

The Wind River Project includes four cooperating agencies. Those are the Underwood Conservation District (UCD), United States Geological Survey (USGS), US Forest Service (USFS), and Washington State Department of Fish & Wildlife (WDFW). Tasks include monitoring steelhead populations (USGS and WDFW), Coordinating a Watershed Committee and Technical Advisory Group (UCD), evaluating physical habitat conditions (USFS and UCD), assessing watershed health (all), reducing road sediments sources (USFS), rehabilitating riparian corridors, floodplains, and channel geometry (UCD, USFS), evaluate removal of Hemlock Dam (USFS), and promote local watershed stewardship (UCD, USFS).

UCD's major efforts have included coordination of the Wind River Watershed Council and the Wind River/White Salmon Technical Advisory Committee (TAC); water temperature and water chemistry monitoring; riparian habitat improvement projects, and educational activities. Our coordination work enables the local Watershed Committee and TAC to function and provide essential input to Agencies, and our habitat improvement work focuses on riparian revegetation. Water chemistry and temperature data collection provide information for monitoring watershed conditions and fish habitat, and are comparable with data gathered in previous years. Water chemistry information collected on Trout Creek should, with the 2 years of data we have collected, determine whether pH levels make conditions favorable for a fish parasite, *Heteropolaria lwoffi*. Educational activities further the likelihood that future generations will continue to understand and enjoy the presence of native fish stocks in the Wind River basin.

Objective 1: Coordination

<u>Task 1a:</u> **Facilitate monthly or bi-monthly meetings of the Wind River Watershed Council (WRWC).**

- Ten WRWC meetings were held during this performance period, all ten facilitated by UCD. A major accomplishment during this period was helping Skamania County to complete a plan for control of Eurasian milfoil, with the WRWC being the main conduit for public input. UCD presented several potential projects to the Council. High priority projects on the middle Wind River (environmental analysis and habitat improvement) and the Little Wind River (habitat analysis) will be worked on by UCD in the next performance period. These two were also submitted for grants through the US Forest Service and the Salmon Recovery Funding Board. The WRWC also hosted a large variety of informational topics, including

- “Firewise” presentation by the Skamania County Extension Forester, helping people learn how to protect their property from loss to wildfire
- A Fish Nutrient enhancement study, being conducted in the Wind River basin by Shannon Claeson, graduate student at Oregon State University.
- An update on Hemlock Dam from Bengt Coffin, USFS
- A presentation about the Mid Columbia Fisheries Enhancement Group, by director Liz Kinne.
- An update on the new Drano Lake boat launch, by Skamania County
- A wonderful presentation by Wind River Middle School students, about their findings from water chemistry sampling on the Wind River and Carson Creek.
- An update on the status of Japanese Knotweed control, from the Skamania County Extension agent.

- The WRWC chair represented the Council at Water Resource Inventory Area 29 (WRIA) Planning Unit meetings.

Task 1b: **Facilitate quarterly meetings with TAC.**

- Four meetings of the Wind River/White Salmon Technical Advisory Committee (TAC) were held during the period. The meetings afford an opportunity for sharing of work information and progress in areas such as Hemlock Dam EIS status (USFS), Hatchery operations (Spring Creek and Carson National Fish Hatcheries), and Fish habitat and population studies (USGS, Columbia River Research Lab). UCD presented potential projects, including two subsequently submitted for grants. The TAC also reviewed work regarding Skamania County’s Eurasian milfoil plan, and WRIA29’s existing conditions draft.

Objective 2: Monitoring

Task 2g: **Monitor water quality and temperature at new and established baseline stations and use the data to determine if water quality is a limiting factor.**

- Continuous summer water temperature monitoring was completed with HOBO® thermographs, from eight thermographs located at seven sites. Ten (nine sites and one duplicate) loggers were launched in May 2003. The Hobos were checked periodically during the summer, to ensure they were not out of water, as stream levels fell during the dry season. Only eight Hobos were retrieved from seven sites in October 2003, and the data were downloaded. Two loggers were lost during the summer, one from lower Bear Creek, and one from the mouth of Trout Creek. The Bear Creek site was obviously tampered with (the rope tying the logger to a tree was cut).
  The data has been forwarded to USGS for analysis, and will be shared with project partners, DOE, and the US Forest Service (USFS). Refer to the USGS 2002-2003 annual report for the temperature results.
- An evaluation of pH levels in the upper Trout Creek drainage continued during the performance period. A total of 50 water chemistry samples were collected from 5 sampling sites during the performance period. We were not able to access most of the sites during winter, due to snow. During those periods, we sampled the lowest elevation site, WR-4a. Sampling occurred monthly, with weekly sampling occurring in November and March.
  In spring 2003, the Wind River/White Salmon TAC suggested exploring pH levels in Trout Creek for one more year. We have accomplished that; we now have a total of 130 samples taken from 5 sampling locations. Overall, no abnormally low pH values were detected. pH averaged 7.03, with the lowest value recorded being 6.52. A more detailed report of the pH study is in Appendix A.
  We are not conducting pH water quality sampling in our 2004-2005 Performance period. We will, however, work with our project partners to determine future water quality sampling needs for which UCD would be the logical organization to conduct.

Objective 3: Assessment

Task 3a: **Update assessment data, revise list of needed projects, and prioritize the list based on value and likely success of desired outcomes.**

- In Winter 2003-4, UCD continued to review and update the Wind River Watershed Enhancement Project (WEP) list. The project status was updated, and entered into GIS from hand maps. Projects were prioritized, and a few new ones added by UCD and the WRWC.

- In Spring, 2004, the Wind River TMDL implementation plan was completed by the Washington Department of Ecology. The plan should help give agencies and individuals a better focus on work aimed at ameliorating high temperatures in the basin.
- In spring, the Lower Columbia Fish Recovery Board released criteria for Salmon Recovery Funding grant applications. These criteria, which utilize EDT and information from fish biologists, is helping the WRWC and UCD to better focus on basin projects with high priority for fish.

Objective 4: <u>Restoration</u>

Place key pieces of LWD to achieve the range of natural variability for the Wind River watershed (75-120 pieces/mile), and plant and thin riparian forest to increase stream shade, provide future LWD and channel stability.

- task a), Stabler Cutbank Project, north of Stabler on the Wind River. During winter and spring 2004, photodocumentation was made twice at this site. The channel stabilization work continues to look good. In spring 2004, UCD planted trees and other riparian vegetation on the site (see subtask C below).
- task b), Jursik reforestation, along the Wind River, north of Stabler. UCD visited these plantings on a vist to the Landowner's property. Seedlings are in good shape. In a related matter, Dave Jursik asked if we could make any recommendations regarding management of his forest lands. UCD prepared a report, attached as Appendix B.
- task c), Sandberg reforestation, north of Stabler, on the Wind River. UCD continued work with landowner John Sandberg in reforesting the river bank on his property. About 4 acres were planted in March 2004 by UCD personnel. Approximately 800 seedlings (Douglas-fir, grand fir, black cottonwood, and red-osier dogwood) were planted on March 29 and 30. Landowner John Sandberg watered trees subsequent to planting. Early indications are that the trees survived very well, with moderate success for the shrubs planted along the river edge.
  In June, 2004, UCD contracted with the Northwest Service Academy to continue work on scotch broom removal on this property. The crew first reworked the Sandberg property on the south side of the Wind River (where the above mentioned plantings were accomplished, and where initial scotch broom removal occurred in 2003), then moved to the north bank of the river. The NWSA crew covered about 5 acres. The landowner piled and burned the resulting slash on-site.
- task d), Price Properties Reforestation, on the Wind River, south of Beaver Campground. Approximately 2 acres were replanted on Price properties in March 2004 by UCD personnel. Planting was with Douglas-fir (about 90%) grand fir (10%), and western redcedar (about 10 trees). Western redcedar were in very poor shape; a frost in the

nursery virtually wiped out this year's crop. The nurseryman gave us a few to try, and we planted some of them in Price Property. We tucked the cedar between dense shrubs and slash, in an attempt to keep them away from browsing elk.
Our 2003 plantings had high mortality, apparently due to hot weather and competition. Because of this, we limited the area we replanted, and tried installing a fiber mulch material around some of the trees. The mulch should hold back vegetative competition, and better enable the tree to survive the summer. Early visits showed very good survivial of trees, but we'll know better the end of the growing season.

- Task e), Lower Wind River Reach, Hot Springs Trail
  This project proved to be too complex to get restarted in the performance period. In addition, landowner Dan Gundersen expressed greater interest in fish habitat restoration work on the Little Wind. As a result, we did not focus much effort into this project in the performance period.

- Task f), Little Wind River Slides, Little Wind River
  We visited the lower Little Wind with engineer Paul Cleary in spring 2004. We identified active slumping activity, and did outline some areas on an old road that could use water bars. In the course of discussions with landowner Dan Gundersen, we determined that the best course would be to do a larger assessment of conditions and fish habitat needs on the lower Little Wind. We will work on that task in our 2004-2005 performance period, hopefully with the help of a SRFB grant that we applied for in spring 2004.

Objective 5: Education
Task 5a, School Support:
Chillers: Two Chillers purchased by UCD continued to be used by Carson Elementary School. The chillers are kept by one of our partners, the US Fish and Wildlife Service's Columbia Gorge Information/Education Office. The Information/Education Office uses them in various educational efforts in Stevenson and Carson.
Wind River Middle School Outdoor Education
UCD assisted this 7-8 grade class in monitoring the lower Wind River and Carson Creek. Also assisting in this effort is the Spring Creek National Fish Hatchery, and the US Army Corps of Engineers. As part of the student's study, UCD furnished stream temperature information from data loggers, that the students could analyze.
The Kanaka Creek Adopt-A-Stream program This program was continued with a field trip in April 2004, with UCD participating. Fieldwork accomplished included water quality measurements and macro-invertebrate identification.

Task 5b, Public Information:
Skamania County Fair: UCD constructed a display, and staffed an informational booth for all 4 days of the Skamania County Fair in Stevenson in August, 2003. UCD made 105 contacts during this time, dispensing information about the District and its programs and offering technical advice.

Arbor Day: UCD participated in Arbor Day by giving away free trees in Stevenson on April 9. 371 trees were distributed to 39 individuals during the day. Our effort was a bit smaller than in 2003, due to fewer staff, volunteers, and trees being available. A press release accompanied the Arbor Day event.
TMDL: As mentioned earlier, the Wind River TMDL plan was completed by the Department of Ecology. The plan will help to focus restoration efforts related to ameliorating high temperatures in the basin.

Task 5c: Provide technical assistance to landowners and agency personnel to develop water resource and habitat enhancement measures for projects on watershed lands.
During the performance period, UCD prepared an examination and report for landowner Dave Jursik (Appendix B), assisted Skamania County with preparation of a plan to control Eurasian milfoil, and provided assistance to landowners John Sandberg, Price Properties Trust, Dick Misner, Dan Gundersen, and Sue Bradford in the form of technical advice and direct assistance (i.e. planting). In addition, UCD made 105 contacts with landowners at the Skamania County Fair, dispensing information and advice.

Report F: Budget Summary

Expenditures by Category:

Underwood Conservation District
Wind River Watershed Project
BPA Project No. 98-019-04
July 1, 2002- June 30, 2003

Category	**Expended**	**Unexpended**
Personnel:	43,634.54	3,708.46
Supplies:	3,055.53	64.47
Overhead:	6,156	-
Travel:	1,158.02	1,125.98
Subcontractors:	9,066.20	(466.20)
Other:	100	-
Total:	63,170.29	3,802.71

Appendix A

Trout Creek pH Assessment
Annual Report
For the period: August 2002-June 2004.

Prepared by Jim White and Rozalind Plumb
(Underwood Conservation District)

Introduction

The following reports the results obtained from the Trout Creek pH Assessment. The pH monitoring program is intended to systematically sample (by season and location) portions of the Trout Creek sub-basin to determine if low pH (acid) surface waters exist.

Trout Creek represents an important summer steelhead spawning and rearing tributary of the Wind River. Recent fish health studies by US Geological Survey Columbia River Research laboratory (CRRL) and US Fish and Wildlife Service (USFWS), have observed the presence of the fish parasite *Heteropolaria lwoffi,* in the Trout Creek basin and surrounding watersheds. This parasite has been associated with low pH levels in waters. This study is aimed at providing data to assist in understanding the mechanisms of the parasite, and to see what conditions make Trout Creek favorable.

UCD, along with CRRL, and US Forest Service created a monitoring schedule and determined which parameters to assess. UCD performed general water chemistry assessments on site for pH, conductivity, dissolved oxygen, and turbidity. Advanced laboratory assessments for alkalinity, total sulfate, total suspended solids and tannins and lignins, were carried out by an approved laboratory. Although pH is the main parameter of interest in this study, the general chemistry parameters were taken to obtain an overall picture of the health of the creek. The advanced laboratory parameters were assessed so the potential source of low pH could be identified (e.g. Sulfate levels may indicate geothermal influences, and Tannins and Lignins may indicate wetland/soil influences).

The frequency of sampling was set at once per month. This would allow for the identification of seasonal variations. In addition, weekly sampling would take place during the months of March and November. These two months were seen as critical as they most often encounter the spring snow melt (March) and the first hard rains after the summer (November). During such times the water quality may be adversely affected by accumulations of factors influencing pH (e.g. the topsoil following a dry summer may enter the creek carrying acidic elements. Snow melt is thought to be a carrier of sulfates from acid rain/ precipitation).

Table 1 Site locations and analyses conducted.

Site ID	Site Description	Distance from mouth of Wind River (km)	General water chemistry (pH, Conductivity, turbidity, DO, temp)	Advanced Chemistry (Alkalinity, TSS, Sulfate, Tannin/Lignin*)
4a	Trout Creek at USFS 43 road	27.29	•	•
4d	Crater Creek	31.46	•	•
4b	Compass Creek	32.54	•	•
4f	Trout Creek at USFS 42 Road	32.03	•	•
4g	Trout Creek at gravel pit	33.15	•	•

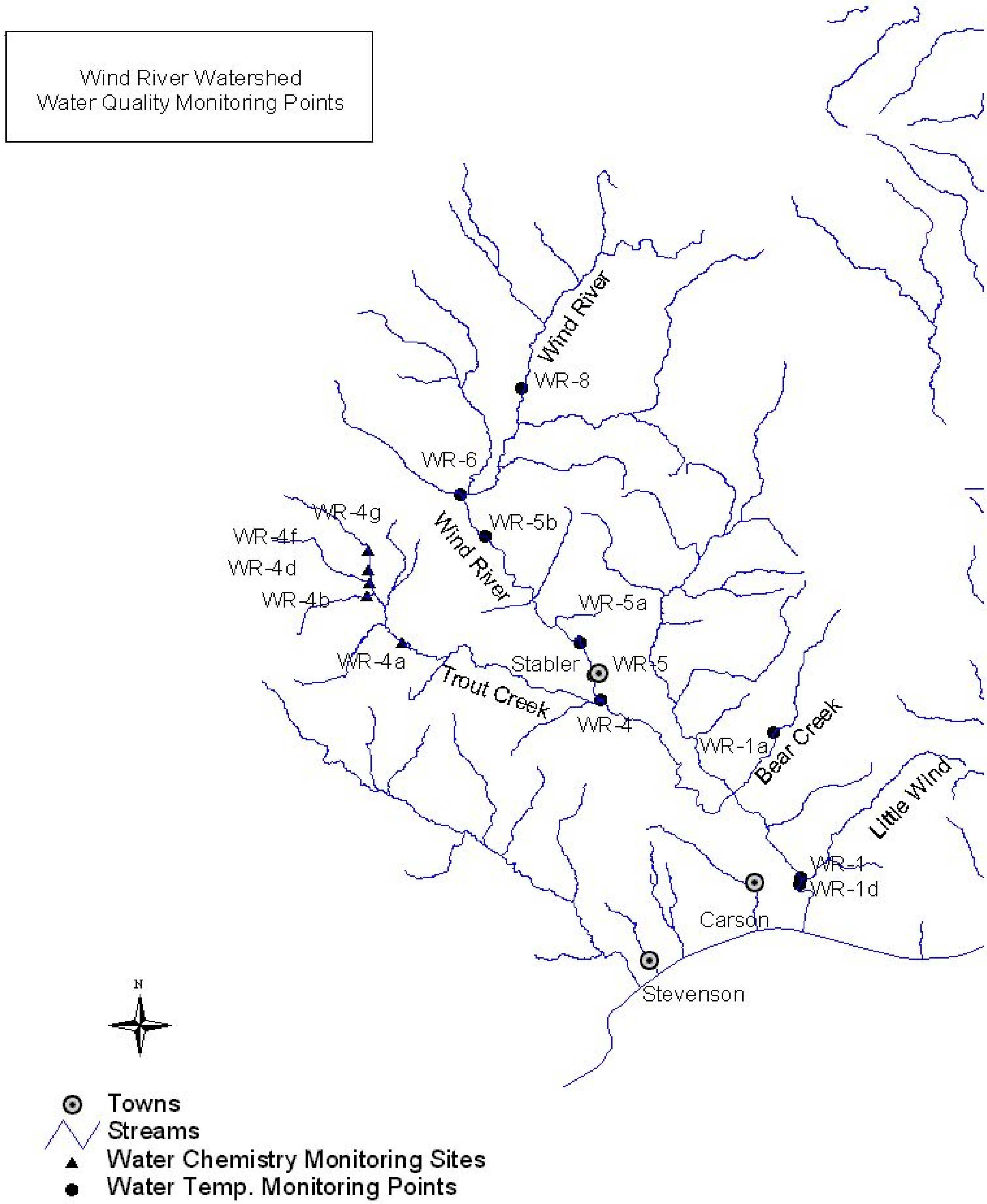


Figure 1. Map of Wind River Water Quality sampling sites used by UCD. pH sampling sites (WR-4a, WR-4b, WR-4d, WR-4f and WR-4g) are on Trout Creek, on the left side of the map.

Table 2. List of monitoring parameters used.

General Water Chemistry	Method
pH (acidity)	Orion 250A meter
Conductivity	Orion 126 meter
Water Temperature	Hanna HI 90-60 digital thermometer
Air Temperature	Alcohol bulb thermometer
Turbidity	HACH 2100P
Dissolved Oxygen	YSI 55/12 meter (and HACH modified Winkler test kit for QA)
Advanced Laboratory Analyses	
Total Suspended Solids (TSS)	EPA 160.2
Alkalinity, total as CaCO3	EPA 310.1
Sulfate	EPA 300.0
Tannins / Lignins	SM 5550 B

Table 3. Monitoring schedule

Site	**Monthly sampling** (12 rounds per year, except if inaccessible due to snow)	**Weekly sampling** (3 extra rounds per month in March and November)
4a Trout Creek at 43 road	•	•
4b Compass Creek	•	•
4d Crater Creek	•	•
4f Trout Creek at 42 road	•	•
4g Trout Creek at gravel pit	•	•

The first year of sampling (winter 2002-2003) was quite dry. UCD and USGS, with approval of BPA, decided to continue for a second year, in case the dry conditions affected results. In the second year, heavy snows blocked access to the sites from late November through March. A limited amount of sampling was accomplished in March, due to logistics and safety considerations. WR-4f was sampled on March 1, and WR-4a was sampled during the remaining weeks of March. Complete sampling began again in April 2004. A total of 30 sampling rounds were accomplished for the 2-year study. Table 4 summarizes the samples collected by each site.

Table 4: Samples per Site

Site	Samples Taken
WR-4a	29
WR-4b	26
WR-4d	26
WR-4f	27
WR-4g	22

Parameter Review and Results.

pH

The major reason for this investigation of Trout Creek water chemistry was an evaluation of pH levels in the stream, as mentioned earlier. pH is a measure of how acidic or basic a water body is. The pH can directly affect the survival of aquatic organisms. Pure water is neutral, with a pH of 7. pH readings below 7 indicate acidic conditions. Waters with pH less than 4 generally have no vertebrate life forms in them. pH readings above pH7 indicate basic conditions. pH affects many chemical and biological processes in water. For example, different organisms flourish within different ranges of pH. The majority of aquatic organisms prefer a range of 6.5 – 8.0. pH outside this range reduces the diversity in the stream because it stresses the physiological systems of most organisms and can reduce reproduction. Low pH can also allow toxic elements and compounds to become mobile and "available" for uptake by aquatic plants and animals. This can produce conditions that are toxic to aquatic life, particularly to sensitive species like rainbow trout. Changes in acidity can be caused by atmospheric deposition (acid rain), surrounding rock, and certain wastewater discharges. (EPA ref 2).

Table 5. pH levels for the sample period Aug 2002-June 2004, with maximum, minimum, mean, and standard deviation.

Date	WR-4a	WR-4b	WR-4d	WR-4f	WR-4g
29-Aug-02	7.85	6.85	6.69	6.59	6.95
25-Sep-02	6.6	6.59	6.54	6.52	6.69
30-Oct-02	7.15	6.95	6.75	6.85	6.91
12-Nov-02	6.98	6.93	6.83	6.92	6.92
18-Nov-02	6.92	6.55	6.74	6.85	6.82
25-Nov-02	6.95	6.91	6.93	6.86	6.94
18-Dec-02	6.82	6.89	6.95	6.84	6.83
29-Jan-03	6.83	6.88	6.76	6.94	6.63
25-Feb-03	7.1	7.08	6.98	7.16	7.01
04-Mar-03	7.11	7.07	7.05	7.1	7.32
11-Mar-03	7.15	7.07	7.04	7.17	7.09
18-Mar-03	7.23	7.26	7.08	7.1	7.13
25-Mar-03	7.02	7.06	7.02	7.08	6.91
29-Apr-03	7.22	7.33	7.15	7.12	7.18
27-May-03	7.34	7.24	7.06	7	7.06
23-Jun-03	7.22	7.08	7.05	7.07	7.04
21-Jul-03	7.2	7.08	7.02	7.07	7.18
18-Aug-03	7.32	6.85	6.77	7.05	7.14
22-Sep-03	7.2	6.71	7.02	7.03	7.21
27-Oct-03	7.31	7.09	7.09	7.26	7.12
04-Nov-03	7.32	7.08	7.21	7.27	
12-Nov-03	7.19	7.22	7.21	7.34	
17-Nov-03	7.01	7.04	7	7.19	
01-Mar-04				6.93	
09-Mar-04	7.21				
16-Mar-04	7.21				
22-Mar-04	6.93				
26-Apr-04	7.13	6.98	6.8	6.98	
24-May-04	7.08	7.12	7.09	7.15	7.1
29-Jun-04	7.19	7.12	7.1	7.2	7.05
Ave	7.13069	7.001154	6.958846	7.023704	7.010455
Max	7.85	7.33	7.21	7.34	7.32
Min	6.6	6.55	6.54	6.52	6.63
Sdev	0.220404	0.189954	0.171542	0.191354	0.170251

Note: On March 22, 2004 the pH meter did not recalibrate at the end of the day. That measurement may be in error.

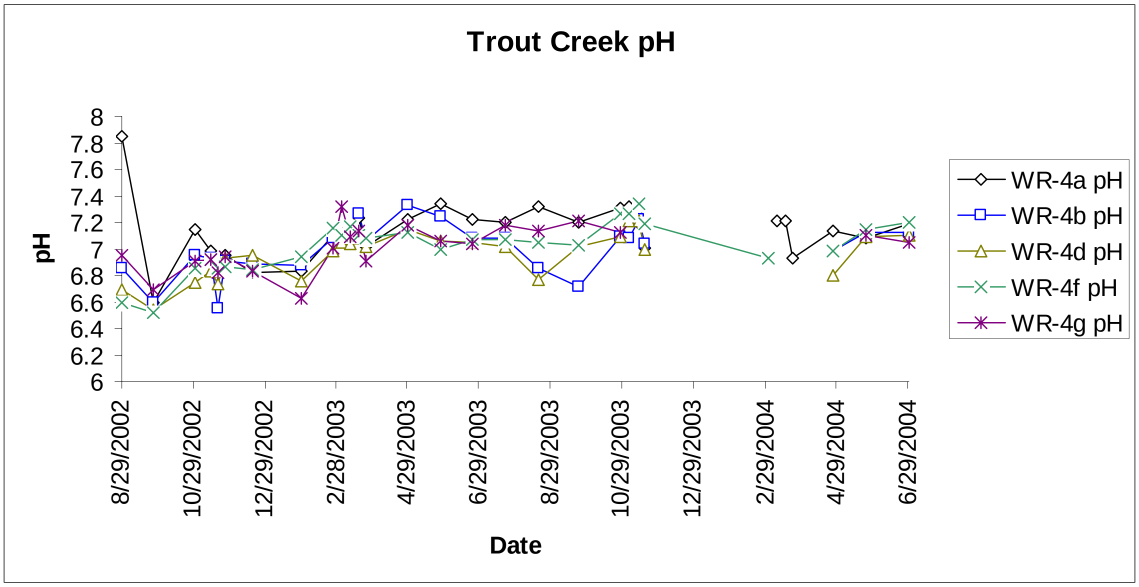


Figure 2. pH for each site displayed by date.

pH Results

Table 5 and Figure 2 display pH data for the entire sampling timeframe. As noted last year, there may have been a slight trend in increasing pH over time, and an increasing trend downstream.

No unusually low pH values were noted during the approximately 2 years of data collection. The lowest value recorded was 6.52, and each of the 5 sites averaged very close to pH 7.0. The lower pH values recorded occurred on a range of sites (Table 6). It does not appear that any one site showed significantly lower pH than other sites.

Table 6: The 10 lowest pH readings

Site	date	pH
WR-4f	9/25/2002	6.52
WR-4d	9/25/2002	6.54
WR-4b	11/18/2002	6.55
WR-4f	8/29/2002	6.59
WR-4b	9/25/2002	6.59
WR-4a	9/25/2002	6.6
WR-4g	1/29/2003	6.63
WR-4d	8/29/2002	6.69
WR-4g	9/25/2002	6.69
WR-4b	9/22/2003	6.71

There may be a slight trend toward lower pH values in winter, and higher in summer (although the lowest values were measured in September). Also, as noted last year, there may be a slight indication of higher pH downstream. WR-4a, the furthest downstream site, had the highest average pH value.

Temperature

The temperature of water in a stream can adversely affect the biological and chemical processes that take place in the water body. According to the Environmental Protection Agency's web page regarding Monitoring and Assessing Water Quality, "Aquatic organisms from microbes to fish are dependent on certain temperature ranges for their optimal health. Optimal temperatures for fish depend on the species: some survive best in colder water, whereas others prefer warmer water. Benthic macroinvertebrates are also sensitive to temperature and will move in the stream to find their optimal temperature. If temperatures are outside this optimal range for a prolonged period of time, organisms are stressed and can die." (EPA ref 1).

"For fish there are two kinds of limiting temperatures, the maximum temperature for short exposures, and a weekly average temperature that varies according to the time of year and the life cycle stage of the fish species. Reproductive stages (spawning and embryo development) are the most sensitive stages" (EPA ref 1).

See Table 7 for temperature criteria for salmonid fishes found in the Columbia River region.

Table 7. Lethal temperatures for selected salmonid species (Bjornn and Reiser 1991).

Species	Lower Lethal temp. °C	Upper Lethal temp. °C	Preferred Range °C
Coho Salmon	1.7	28.8	12-14
Chinook Salmon	0.8	26.2	12-14
Steelhead	0.0	23.9	10-13
Rainbow Trout	-	29.4	-
Cutthroat trout	0.6	22.8	-

Washington State Department of Ecology has set water quality standards for surface waters (WAC 173-201A). Limits have been set for temperatures, dissolved oxygen (DO),and turbidity in different class streams. Washington State has 4 classes ranging from Class AA (extraordinary), through Class C (fair). All the sites in this study are on federal land (US Forest Service) and are required to meet Class AA standards (Table 8).

Table 8 Washington State surface water quality standards.

Class	Temperature *C shall not exceed	DO mg/L shall exceed	pH range shall be within
AA	16	9.5	6.5 - 8.5

'Temperature affects the oxygen content of the water (oxygen levels become lower as temperature increases); the rate of photosynthesis by aquatic plants; the metabolic rates of aquatic organisms; and the sensitivity of organisms to toxic wastes, parasites, and diseases.' (EPA ref 1) As temperature increases the organisms use up more oxygen as respiration increases while they adjust to cope with the rising temperature.

Factors affecting stream water temperatures include the weather, the amount of vegetation providing shade along the stream bank, groundwater inflows, the volume of water, the depth of the water, impoundments (barriers such as dams that restrict the flow), and the turbidity of the water. Wide shallow streams with slow flows are more likely to have increased temperatures as more of the water body is exposed to sunlight for a longer period of time compared to water in a narrow, deep channel with a rapid flow. 'Stream temperatures can be altered by removal of streambank vegetation, withdrawal and return of water for irrigation, release of water from deep reservoirs, and cooling of nuclear power plants.' (Bjornn and Reiser, 1991).

Manual temperatures were collected during the sampling period, while gathering general water chemistry data (pH, DO, etc.). This temperature data helps to monitor the effect water temperature may have on the other data. The data also gives us a "snapshot" in time of temperature information. However, since it is only a snapshot, it probably tells us little about the temperature status of the stream. For detailed temperature data continuous monitoring is required (see USGS annual reports).

Table 9. Temperature data gathered during water chemistry sampling at each site, with maximum, minimum, mean, and standard deviation.

date	WR-4a	WR-4b	WR-4d	WR-4f	WR-4g
29-Aug-02	14.8	13.5	14.8	5.8	13.6
25-Sep-02	10.5	10.1	9.8	5.1	9.0
30-Oct-02	3.6	3.3	5.0	4.0	2.0
12-Nov-02	6.9	6.3	6.4	5.8	7.1
18-Nov-02	6.5	6.1	6.1	5.6	6.5
25-Nov-02	4.9	4.4	4.2	4.7	3.8
18-Dec-02	4.4	4.2	4.2	4.7	5.0
29-Jan-03	4.3	4.0	4.0	4.5	4.6
25-Feb-03	3.6	2.1	2.8	3.7	2.5
04-Mar-03	4.7	3.6	3.7	4.3	3.8
11-Mar-03	4.9	4.0	4.2	4.7	4.7
18-Mar-03	5.1	4.4	4.3	4.6	4.6
25-Mar-03	5.2	4.5	4.6	4.7	4.9
29-Apr-03	7.9	6.1	6.5	5.3	6.0
27-May-03	9.5	7.7	8.0	4.8	7.1
23-Jun-03	9.1	8.2	9.1	4.8	8.3
21-Jul-03	13.3	13.0	13.1	5.2	13.8
18-Aug-03	16.0	13.6	15.1	5.3	13.0
22-Sep-03	12.9	11.0	10.5	6.1	9.6
27-Oct-03	9.0	8.7	8.4	6.3	6.8
04-Nov-03	4.7	4.4	4.3	5.4	
12-Nov-03	6.5	5.8	5.9	5.9	
17-Nov-03	6.6	6.4	6.3	6.4	
09-Mar-04	5.5			5.7	
16-Mar-04	5.5				
22-Mar-04	6.4				
26-Apr-04	8.8	6.2	6.4	5.7	
24-May-04	7.5	8.2	8.9	6.4	8.6
29-Jun-04	14.6	11.3	12.7	6.7	10.5
Mean	7.7	7.0	7.3	5.3	7.1
Max	16.0	13.6	15.1	6.7	13.8
Min	3.6	2.1	2.8	3.7	2.0
Sdev	3.59	3.34	3.54	0.78	3.42

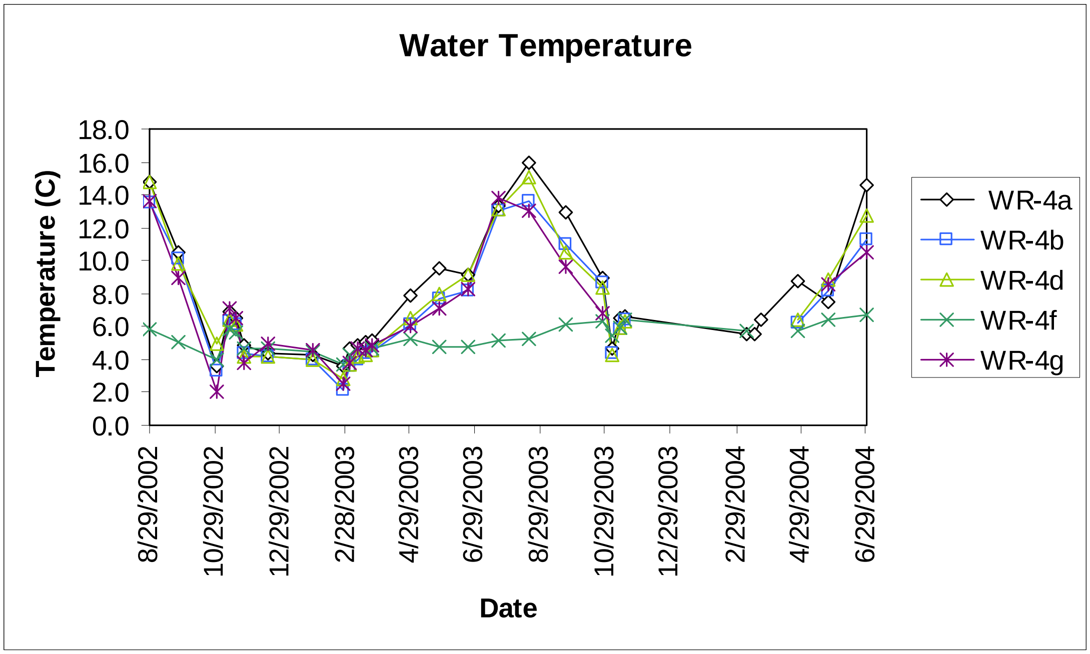


Figure 3. Water temperature data collected during the sampling period August 2002 to June 2004.

As would be expected, temperature fluctuated seasonally. Site 4f continued to display consistently cool temperatures throughout the year (max. 6.7, min. 3.7), likely due to groundwater input just upstream.

Dissolved Oxygen

Dissolved oxygen (DO) is a measure of the amount of oxygen dissolved in water. It is important for determining whether the water body can support organisms which require oxygen – aerobic organisms – such as fish and zooplankton. High dissolved oxygen levels are better. Generally, levels of 5-6 mg/L can support diverse forms of aquatic life (USGS ref1).

DO is both produced and consumed in the stream system. Oxygen is acquired from the atmosphere and from plants as a result of photosynthesis. Running water dissolves more oxygen than still water as the turbulence at the water surface traps more air. Aquatic animal respiration, decomposition, and various chemical reactions consume oxygen. ‘Oxygen is measured in its dissolved form as DO. If more oxygen is consumed than is produced, DO levels decline and some sensitive animals may move away, weaken, or die.’ (EPA ref 3).

‘DO levels fluctuate seasonally and over a 24-hour period. They vary with water temperature and altitude. Cold water holds more oxygen than warm water and water holds less oxygen at higher altitude. Aquatic animals are most vulnerable to lowered DO levels in the early morning on hot summer days when stream flows are low. Water temperatures are high, and aquatic plants have not been producing oxygen since sunset.’ (EPA ref 3).

Table 10. DO levels with minimum, maximum, mean, standard deviation, and the state minimum requirement for the creeks on federal land. (DO not reported for 4a on 12 Nov 2002, due to recording error)

	WR-4a	WR-4b	WR-4d	WR-4f	WR-4g
Date	DO mg/L	DO mg/L	DO mg/L	DO mg/L	DO mg/L
29-Aug-02	8.96	7.8	7.59	10.5	8.39
25-Sep-02	11.36	9.22	10.65	12.25	10.51
30-Oct-02	12.86	11.54	9.84	12.4	12.75
12-Nov-02		11.48	11.49	11.84	11.43
18-Nov-02	11.86	11.77	11.77	12.17	11.75
25-Nov-02	12.13	12.15	12.43	12.42	12.61
18-Dec-02	11.18	12.33	12.44	12.57	11.18
29-Jan-03	10.25	12.04	12.17	12.24	12.58
25-Feb-03	12.67	13.14	12.82	12.51	13.21
04-Mar-03	12.23	12.24	12.56	12.34	12.97
11-Mar-03	12.21	12.55	12.63	12.55	13.26
18-Mar-03	12.19	12.54	12.7	12.71	12.5
25-Mar-03	12	12.35	12.56	12.54	13.65
29-Apr-03	11.86	12.06	12.04	12.3	12.13
27-May-03	11.84	11.43	11.33	12.13	11.45
23-Jun-03	11.4	10.94	10.69	11.27	11.21
21-Jul-03	10.04	8.51	8.27	11.89	8.92
18-Aug-03	10.38	8.28	8.2	12.62	9.45
22-Sep-03	10.9	9.42	9.8	12.03	11.71
27-Oct-03	10.98	10.54	10.74	11.6	12.02
04-Nov-03	12.57	12.44	12.26	12.61	
12-Nov-03	11.89	11.74	12.01	12.15	
17-Nov-03	11.85	11.97	11.88	12	
09-Mar-04	12.73			12.42	
16-Mar-04	12.73				
22-Mar-04	12.83				
26-Apr-04	11.92	12.41	12.05	15.9	
24-May-04	10.93	11.65	11	12.05	12.09
29-Jun-04	10.38	10.7	9.88	11.92	11.15
Ave	11.61179	11.27846	11.22308	12.2937	11.67818
Max	12.83	13.14	12.82	15.9	13.65
Min	10.04	8.28	8.2	11.27	8.92
Sdev	0.972507	1.457056	1.492318	0.859737	1.380427
Class AA Min.	9.5	9.5	9.5	9.5	9.5

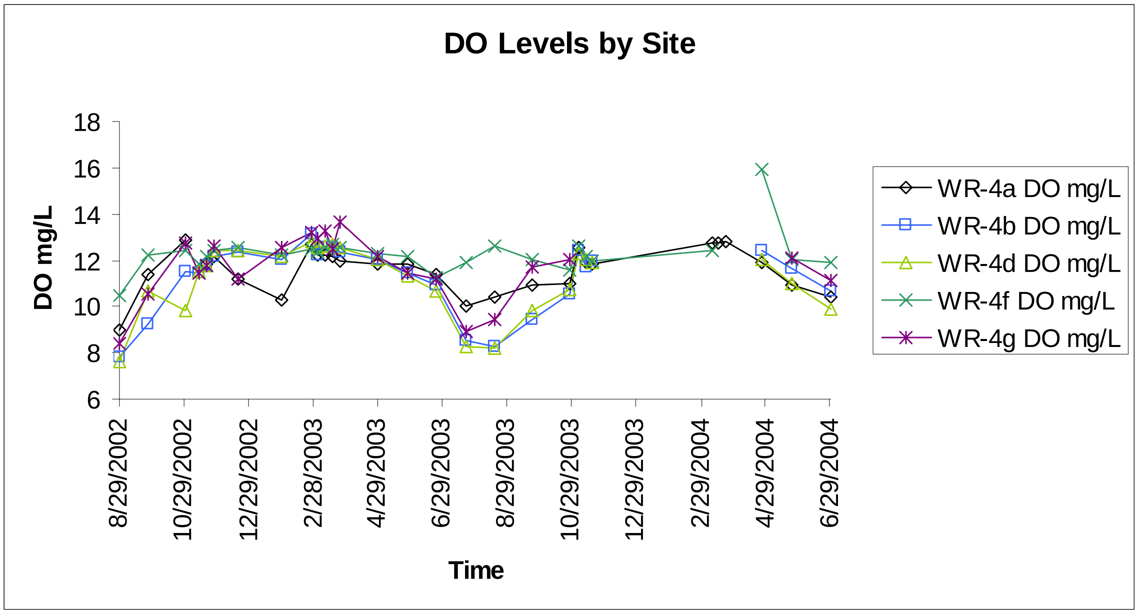


Figure 4. DO levels for each site over the sampling period.

Trout Creek at site 4f (km 32.03) has higher DO on average throughout the year compared to the other sites (figure 4 and Table 10), and varies the least. This correlates with the temperatures recorded at the time of sampling (fig 10). Site 4f is consistently cooler and temperature fluctuates little over the year. The general trend in fig 11 indicates a decrease in DO downstream. It also indicates that the two tributaries, Compass Creek and Crater Creek, have slightly lower average DO compared to Trout Creek.

DO remains fairly constant but there are slight variations that appear to correlate with changes in temperature, which would be expected. August 2002 shows all but site 4f, were below the state Class AA minimum. This also coincides with the highest temperatures recorded for all the sites. 4b (Crater Creek) was also below the state standard in September. Site 4f has consistently cool temperatures which helps DO remain fairly constant and above the state minimum.

DO Summary

Dissolved oxygen levels were above the state standard (9.5 mg/L) in all but 12 measurements. Those 12 all occurred in July, August, and September, indicating an expected trend toward lower dissolved oxygen levels with increasing water temperature. Those 12 readings occurred on 4 of the 5 sample sites, with the single exception being WR-4f. WR-4f also displayed the most consistent DO levels, reflecting its cool, consistent temperature.

Turbidity

Turbidity is a measure of the clarity of the water. The amount of debris, soil particles, or plankton in the water affects the amount of sunlight that reaches aquatic plants. High turbidity will reduce the amount of light passing through the water column and reduce the plant's ability for photosynthesis, and so reduce the amount of available oxygen in the water. Excess silt and detritus in the water can also smother spawning areas, covering eggs with silt so they cannot breathe.

'Higher turbidity increases water temperatures because suspended particles absorb more heat. This in turn, reduces the concentration of dissolves oxygen (DO) because warm water holds less DO than cold.' (EPA ref 4). 'Suspended materials can clog fish gills, reducing resistance to disease in fish, lowering growth rates, and affecting egg and larval development. As the particles settle, they can blanket the stream bottom, especially in slower waters, and smother fish eggs and benthic macroinvertebrates. Sources of turbidity include; soil erosion, waste discharge, urban runoff, eroding stream banks, and excessive algal growth.

Regular monitoring of turbidity can help detect trends that might indicate increasing erosion in developing watersheds. However, turbidity is closely related to stream flow and velocity and should be correlated with these factors. Comparisons of the change in turbidity over time, therefore should be made at the same point at the same flow. Turbidity is not a measurement of the amount of suspended solids present or the rate of sedimentation of a stream since it measures only the amount of light that is scattered by suspended particles.' (EPA ref 4).

Table 11. Turbidity data for the sample period. (No turbidity data exists for May and June 2003 as the meter was out of service).

	WR-4a	WR-4b	WR-4d	WR-4f	WR-4g
Date	Turbidity	Turbidity	Turbidity	Turbidity	Turbidity
29-Aug-02	0.24	0.9	0.63	1.97	1.64
25-Sep-02	0.29	0.25	0.69	0.51	0.64
30-Oct-02	0.26	0.37	0.27	0.41	2.82
12-Nov-02	2.32	0.76	0.67	1.41	0.96
18-Nov-02	0.57	0.42	0.27	0.29	0.36
25-Nov-02	0.28	0.24	0.28	0.24	0.6
18-Dec-02	0.76	0.54	0.36	1.08	0.76
29-Jan-03	1.85	0.64	0.66	0.46	0.66
25-Feb-03	0.65	0.46	0.36	0.37	0.41
04-Mar-03	0.54	0.27	0.33	0.29	0.5
11-Mar-03	1	0.41	0.35	0.34	0.45
18-Mar-03	0.7	0.37	0.33	0.43	0.47
25-Mar-03	1.19	0.57	0.58	0.55	0.51
29-Apr-03	0.51	0.25	0.39	0.3	0.51
27-May-03					
23-Jun-03					
21-Jul-03	0.52	0.25	0.41	0.8	0.63
18-Aug-03	0.67	0.3	0.59	0.43	0.94
22-Sep-03	0.47	0.33	0.5	0.56	1.34
27-Oct-03	0.33	0.35	0.4	0.51	0.69
04-Nov-03	0.34	0.31	0.31	0.31	
12-Nov-03	0.46	0.3	0.37	0.36	
17-Nov-03	1.94	1.88	1.72	0.79	
09-Mar-04	0.98			0.31	
16-Mar-04	0.98				
22-Mar-04	0.6				
26-Apr-04	0.7	1.08	0.3	0.82	
24-May-04	0.53	0.41	0.52	0.41	0.63
29-Jun-04	0.41	0.45	0.51	0.52	0.8
Ave	0.744074	0.504583	0.491667	0.5788	0.816
Max	2.32	1.88	1.72	1.97	2.82
Min	0.24	0.24	0.27	0.24	0.36
Sdev	0.120208	0.318198	0.084853	1.025305	0.59397

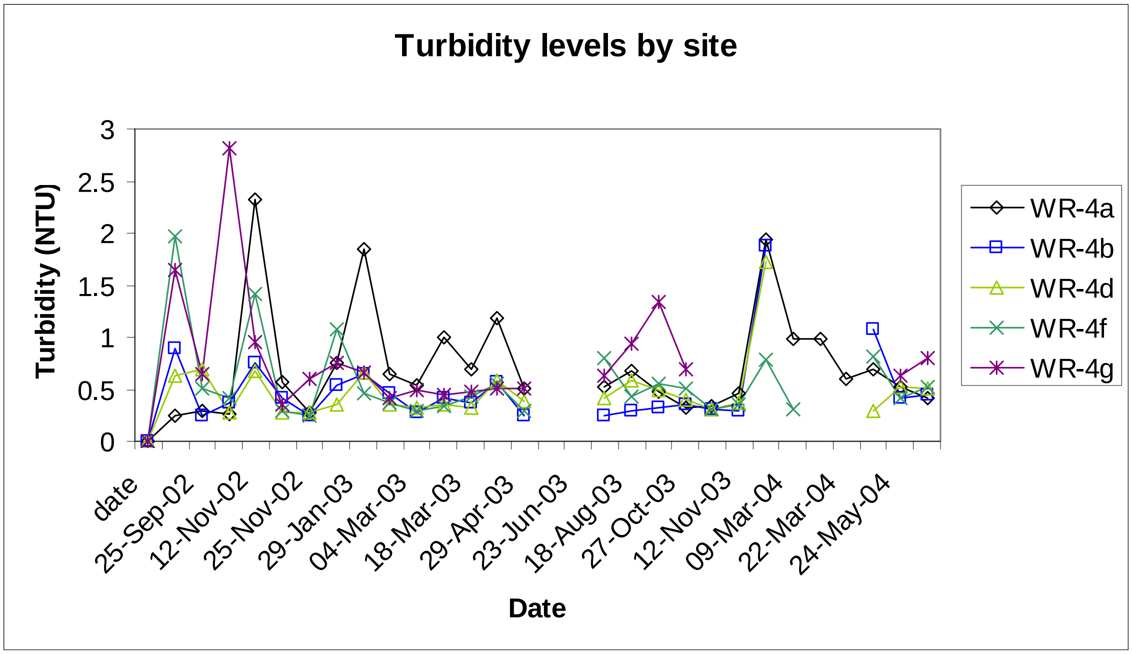


Figure 5. Turbidity levels by site during the sampling period.

Turbidity levels were consistently low on all the dates sampled, with higher levels generally occurring during winter storms and periods of higher flow. Sites WR-4a and 4g showed the highest average turbidity and the highest individual values.

Conductivity

Conductivity is a measure of the ability of water to pass an electrical current. Conductivity in water is affected by the presence of inorganic dissolved solids such as chloride, nitrate, sulfate, and phosphate anions. (ions that carry a negative charge) or sodium, magnesium, calcium, iron, and aluminum cations (ions that carry a positive charge). Organic compounds like oil, phenol, alcohol, and sugar do not conduct electrical current very well and therefore have low conductivity when in water. Conductivity is also affected by temperature; the warmer the water, the higher the conductivity. For this reason, conductivity is reported at 25 degrees Celsius (25C). Conductivity in streams and rivers is affected primarily by the geology of the area through which the water flows. Streams than run through areas with clay soils tend to have higher conductivity because of the presence of materials that ionize when washed into the water. Ground water inflows can have the same effects depending on the bedrock they flow through.

The conductivity of rivers in the United States generally ranges from 50 to 1500 ms/cm (microsiemens per centimeter). Studies of inland fresh waters indicate that streams supporting good mixed fisheries have a range between 150 and 500 ms/cm. Conductivity outside this range could indicate that the water is not suitable for certain species of fish of macroinvertebrates.’ (EPA ref 5)

Conductivity is useful as a general measure of stream water quality. Each stream tends to have a relatively constant range of conductivity that, once established, may be used as a baseline for comparison with regular conductivity measurements. Significant changes in conductivity could then be an indicator that a discharge or some other source of pollution has entered a stream (EPA ref. 5).

Table 12. Conductivity levels (microsiemens per centimeter) for the sample period August 2002 to June 2004, with Minimum, maximum, mean, and standard deviation.

Date	WR-4a	WR-4b	WR-4d	WR-4f	WR-4g
29-Aug-02	29.1	36.1	34	27.2	33.4
25-Sep-02	30.7	39.3	36	28.5	35.3
30-Oct-02	31.3	36.8	38.7	28.3	34.8
12-Nov-02	31.2	31.4	30.7	29.6	32.9
18-Nov-02	28	27	26	28	31.9
25-Nov-02	27.4	28	25	25.6	31.7
18-Dec-02	21.5	21.9	18.4	20.4	21.5
29-Jan-03	19.7	21.4	17.8	19.3	20.2
25-Feb-03	21.1	21.7	18.3	20.7	22.6
04-Mar-03	20.1	23.9	20.3	21.4	24
11-Mar-03	21.4	21.2	18.96	22.3	23.8
18-Mar-03	22.1	23.3	19.14	20.9	22.5
25-Mar-03	21	22.2	18.17	19.74	20.8
29-Apr-03	24.8	26	22.1	22.9	26.2
27-May-03	27.2	26.7	25	24.1	28.1
23-Jun-03	28.1	32.2	29.3	25.3	31.1
21-Jul-03	30.2	77	36.1	27.6	34.7
18-Aug-03	31	42.3	38.2	28.8	37.4
22-Sep-03	33.3	37.4	39.5	30	38
27-Oct-03	33.4	32.6	34.9	30.5	30.26
04-Nov-03	32.2	31.2	32.7	30	
12-Nov-03	31.8	30.5	28.6	30.6	
17-Nov-03	27.6	24.6	25.7	30.6	
09-Mar-04	23.2			23.9	
16-Mar-04	23.2				
22-Mar-04	24.1				
26-Apr-04	24.7	25.4	21.7	22.3	
24-May-04	26.6	28.8	23.6	22.9	27.9
29-Jun-04	28	31.3	27.2	24.3	29.3
Ave	26.68966	30.77692	27.15654	25.39778	29.01636
Max	33.4	77	39.5	30.6	38
Min	19.7	21.2	17.8	19.3	20.2
Sdev	4.29737	11.1476	7.22538	3.792581	5.605149

Conductivity Summary

Based on the data collected, conductivity ranges from the high teens to high 30s. Site WR-4b, on July 21 2003, showed a value about twice as high as any other measure during the study; this may be an error in reading the instrument, or an instrument error, it does not seem to be consistent with other data. Dramatic increases or decreases were not observed, other than this one instance. In general conductivity was higher during low flow periods, (possibly due to increased concentration with less water volume).

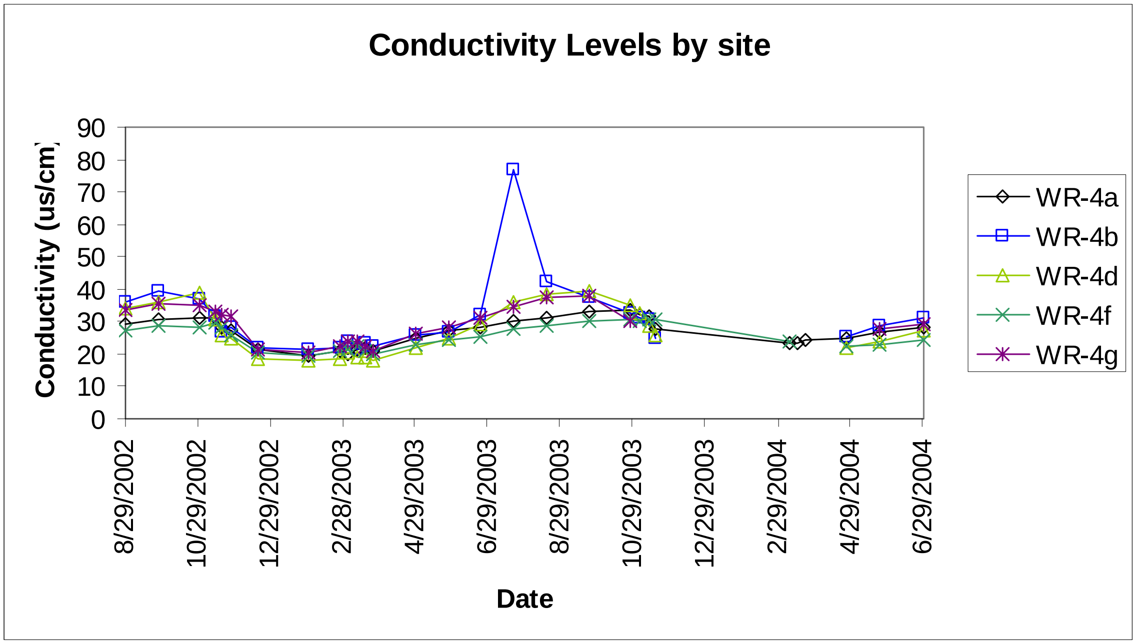


Figure 6. Conductivity levels by site during the sampling period.

Advanced Chemical Analysis

Samples were collected in laboratory prepared sample bottles for Alkalinity, Total suspended solid. Sulfate, tannins and lignins. The samples were sent to an EPA certified laboratory who analyzed the samples using EPA methodologies.

Columbia Analytical Services
1317 South 13th Avenue
Kelso WA.

Total Suspended Solids

Total suspended solids (TSS) is an assessment of the amount of solid material suspended in the water column. Suspended solids include silt, clay, plankton, algae, organic debris, and other particulate matter. High concentrations act as carriers for toxins. As with turbidity, suspended sediments can affect fish habitat by increasing water temperatures and reduction of dissolved oxygen from reduced photosynthesis.

Sampling in Trout Creek almost always resulted in no detection of TSS, the water was very clear. With the EPA TSS testing method 160.2 the reporting level was 5mg/L, only 6 out of the 64 samples were above this reporting level, and each of those readings were low (5, 6, or 7mg/L).

TSS Summary

Based on the data collected, TSS levels were very low, (almost always below the tests reporting/detection limit). Although it appears that the readings are non existent, this is still 'good data' as it is contributing to the establishment of normal / background levels (normally below 5mg/L).

Table 13. Total Suspended Solid (TSS) levels for the sample period August 2002-June 2004.

	WR-4a	WR-4b	WR-4d	WR-4f	WR-4g
date	TSS mg/L	TSS mg/L	TSS mg/L	TSS mg/L	TSS mg/L
29-Aug-02	<5	<5	<5	<5	<5
25-Sep-02	<5	<5	<5	<5	<5
30-Oct-02	<5	<5	<5	<5	<5
12-Nov-02	<5	<5	<5	<5	<5
18-Nov-02	<5	<5	<5	<5	<5
25-Nov-02	<5	<5	<5	<5	<5
18-Dec-02	<5	<5	<5	<5	<5
29-Jan-03	<5	<5	<5	<5	<5
25-Feb-03	<5	<5	<5	<5	<5
04-Mar-03	<5	<5	<5	6	<5
11-Mar-03	<5	<5	<5	<5	6
18-Mar-03	<5	<5	<5	<5	<5
25-Mar-03	<5	<5	<5	<5	<5
29-Apr-03	<5	<5	<5	5	<5
27-May-03	<5	<5	6	<5	<5
23-Jun-03	<5	<5	7	<5	7
21-Jul-03	<5	<5	<5	<5	<5
18-Aug-03					
22-Sep-03	<5	<5	<5	<5	<5
27-Oct-03	<5	<5	<5	<5	
04-Nov-03	<5	<5	<5	<5	
12-Nov-03	<5	<5	<5	<5	
17-Nov-03	<5	<5	<5	<5	<5
09-Mar-04	<5			<5	
16-Mar-04	<5				
22-Mar-04	<5				
26-Apr-04	<5	<5	<5	<5	
24-May-04	<5	<5	<5	<5	<5
29-Jun-04					

Alkalinity

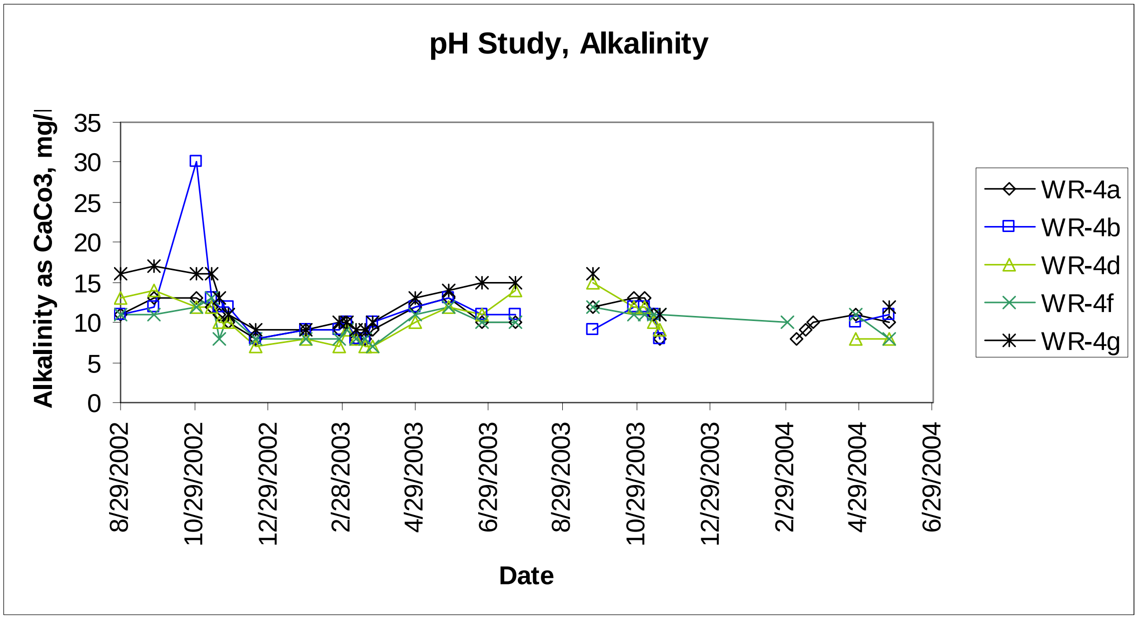
Alkalinity is a measure of the capacity of water to neutralize acids (see pH description). Alkaline compounds in the water such as bicarbonates (baking soda is one type), carbonates, and hydroxides remove H+ ions and lower the acidity of the water (which means increased pH). They usually do this by combining with the H+ ions to make new compounds. Without this acid-neutralizing capacity, any acid added to a stream would

cause an immediate change in the pH. Measuring alkalinity is important in determining a stream's ability to neutralize acidic pollution from rainfall or wastewater. It's one of the best measures of the sensitivity of the stream to acid inputs.
Alkalinity in streams is influenced by rocks and soils, salts, certain plant activities, and certain industrial wastewater discharges. For fish, alkalinity can be important in maintaining the acidic level of streams in an acceptable range.
Total alkalinity is assessed by measuring the amount of acid (e.g., sulfuric acid) needed to bring the sample to a pH of 4.2. At this pH all the alkaline compounds in the sample are "used up." The result is reported as milligrams per liter of calcium carbonate (mg/L $CaCO_3$).

Table 14. Alkalinity levels for each site with minimum, maximum, mean, and standard deviation.

			Alkalinity as CaCo3 mg/L		
date	WR-4a	WR-4b	WR-4d	WR-4f	WR-4g
29-Aug-02	11	11	13	11	16
25-Sep-02	13	12	14	11	17
30-Oct-02	13	30	12	12	16
12-Nov-02	12	13	12	13	16
18-Nov-02	11	12	10	8	13
25-Nov-02	10	12	10	11	11
18-Dec-02	8	8	7	8	9
29-Jan-03	9	9	8	8	9
25-Feb-03	9	9	7	8	10
04-Mar-03	10	10	9	9	10
11-Mar-03	8	8	8	8	9
18-Mar-03	8	8	7	8	9
25-Mar-03	9	10	7	7	10
29-Apr-03	12	12	10	11	13
27-May-03	13	13	12	12	14
23-Jun-03	10	11	11	10	15
21-Jul-03	10	11	14	10	15
18-Aug-03					
22-Sep-03	12	9	15	12	16
27-Oct-03	13	12	12	11	
04-Nov-03	13	12	12	11	
12-Nov-03	11	11	10	11	
17-Nov-03	8	8	9	11	11
				10	
09-Mar-04	8				
16-Mar-04	9				
22-Mar-04	10				
26-Apr-04	11	10	8	11	
24-May-04	10	11	8	8	12
29-Jun-04					
Ave	10.40741	11.33333	10.20833	10	12.55
Max	13	30	15	13	17
Min	8	8	7	7	9
Sdev	1.759791	4.290198	2.466809	1.683251	2.874113

Figure 7 Alkalinity level for each site, August 2002 to June 2004.



Trout Creek samples show fairly stable levels of CaCO3. The lowest levels appear in the winter and increase as flows decrease in to the summer. Compass Creek (4b) has the highest reading (30 mg/L) in October 2002. This is unusually high compared to the rest of the sites on that date, and even compared to previous and subsequent readings at the same site. Nothing in our records indicates sampling problems on the part of field collection or laboratory procedures. A note from the Compass Creek site that day says that the water level was very low.

Alkalinity Summary

Overall alkalinity fluctuated gradually, and coincided with seasonal changes in temperatures and flow.

Sulfate

Sulfate is a measure of the acid in water. Sulfates enter streams from acid rain, rocks and soils, and from plant materials. Coniferous plants are often acidic and produce acidic soils. Precipitation falling onto acidic detritus and soils will pick up some of the acidity. It was speculated that the snow pack may contribute to increased acidity into Trout Creek. Snow may fall as an acidic precipitation, and /or pick up acid from the soils and plants on which it settles. The slow melting of snow allows the water to remain on acidic surfaces longer than a rain storm might, and so have a better chance of absorbing acids. Samples were analyzed using EPA method 300.0, with a method reporting limit of 0.2mg/L.

Table 15. Sulfate levels recorded for the sample period August 2002 to June 2004, with minimum, maximum, mean, standard deviation and method reporting limit.

date	WR-4a	WR-4b	WR-4d	WR-4f	WR-4g
29-Aug-02	1.1	1.1	1.5	1	0.4
25-Sep-02	1.2	1.2	1.8	1	0.4
30-Oct-02	1.1	0.9	1.8	1.1	0.3
12-Nov-02	0.9	0.8	1.3	0.9	0.4
18-Nov-02	0.7	0.7	0.8	0.9	0.4
25-Nov-02	0.8	0.7	0.9	1	0.4
18-Dec-02	0.5	0.6	0.6	0.6	0.4
29-Jan-03	0.5	0.6	0.5	0.5	0.3
25-Feb-03	0.6	0.7	0.7	0.6	0.5
04-Mar-03	0.6	0.7	0.8	0.6	0.4
11-Mar-03	0.6	0.7	0.7	0.6	0.5
18-Mar-03	0.6	0.6	0.6	0.6	0.4
25-Mar-03	0.6	0.7	0.7	0.6	0.5
29-Apr-03	0.7	0.8	0.7	0.7	0.5
27-May-03	0.6	0.7	0.7	0.6	0.3
23-Jun-03	0.7	0.9	1	0.7	0.3
21-Jul-03	0.9	1	1.4	0.8	0.3
18-Aug-03					
22-Sep-03	1.1	0.9	2.3	1.1	0.2
27-Oct-03	1	0.9	1.3	1.1	0.3
04-Nov-03	1	0.8	1.3	1.2	0.3
12-Nov-03	0.8	0.7	0.9	1.1	
17-Nov-03	0.6	0.5	0.8	0.7	
				0.6	
09-Mar-04	0.5				
16-Mar-04	0.5			0.6	
22-Mar-04	0.5			0.6	
26-Apr-04	0.5	0.6	0.6	0.6	
24-May-04	0.6	0.7	0.6	0.6	0.3
29-Jun-04					
Ave	0.733333	0.770833	1.0125	0.777778	0.371429
Max	1.2	1.2	2.3	1.2	0.5
Min	0.5	0.5	0.5	0.5	0.2
Sdev	0.223607	0.168056	0.472102	0.218972	0.084515
Method Reporting Limit	0.2	0.2	0.2	0.2	0.2

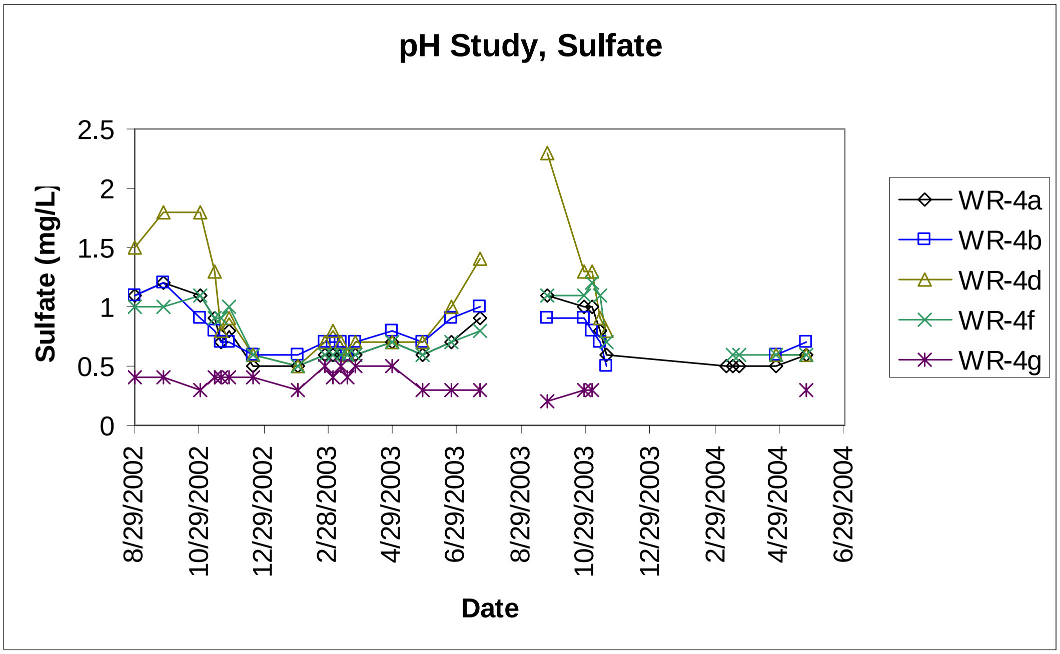


figure 8. Sulfate levels for each site from August 2002 to June 2004.

Based on the data collected, the sulfate levels appeared to be higher in fall, and lowest in winter, when flows were highest. The highest sulfate levels were in September and October. In particular, Compass Creek (4b) had very high readings during periods of low flow. Upper Trout Creek at site 4g consistently displayed the lowest levels throughout the year, and fluctuated very little. The higher sulfate readings in the late summer may have been due to increased temperatures and low flows causing sulfate to be in higher concentration.

Sulfate Summary

Sulfate was highest in the late summer, and appears to fluctuate seasonally being lower in winter when flows are higher (possibly diluting sulfate levels). The trend appears to coincide with the lowest pH readings also in late summer. pH increased slightly as sulfate decreased through the winter. Sulfate levels increased slightly downstream.

Tannins and Lignins

Tannins and lignins can enter the stream system from decaying plant material. They can contribute to the acidity of water, lowering the pH. Sampling for tannins and lignins may help identify a source if the waters are found to be acidic.

Samples were taken only a few times during the sample period due to the high cost of the analysis. Columbia Analytical Services used Standard Method SM 5550 B with a method reporting limit of 0.2mg/L.

Table 16. Tannin and lignin levels recorded during the sampling period August 2002-June 2004.

Date	WR-4a	WR-4b	WR-4d	WR-4f	WR-4g
29-Aug-02	<.2	<.2	0.2	<.2	0.2
25-Sep-02					
30-Oct-02					
12-Nov-02					
18-Nov-02	0.4	0.3	0.4	<.2	0.3
25-Nov-02					
18-Dec-02					
29-Jan-03					
25-Feb-03					
04-Mar-03					
11-Mar-03	<.2	<.2	<.2	<.2	<.2
18-Mar-03	0.3	0.2	0.3	<.2	<.2
25-Mar-03	0.3	<.2	0.2	<.2	<.2
29-Apr-03	0.2	<.2	<.2	<.2	<.2
27-May-03	<.2	<.2	<.2	<.2	<.2
23-Jun-03	<.2	<.2	0.3	<.2	<.2
21-Jul-03	<.2	<.2	0.3	<.2	0.3
18-Aug-03	<.2	<.2	0.3	<.2	0.3
22-Sep-03					
27-Oct-03					0.9
04-Nov-03	0.2	0.2	0.3	<0.2	
12-Nov-03	0.6	0.4	0.6	0.3	
17-Nov-03	0.9	0.6	0.8	0.7	
01-Mar-04				<.2	
09-Mar-04	0.3				
16-Mar-04	0.2				
22-Mar-04	<.2				
26-Apr-04	<.2	<.2	<.2	<.2	
24-May-04	.2	<.2	0.2	<.2	0.3
29-Jun-04					
Ave	0.414286	0.34	0.354545	0.5	0.383333
Max	0.9	0.6	0.8	0.7	0.9
Min	0.2	0.2	0.2	0.3	0.2
Sdev	0.254484	0.167332	0.186353	0.282843	0.256255

From the data gathered, it appears that tannins and lignins contribute limited amounts to the water. A majority of the readings were below the method reporting limit of 0.2mg/L.

pH values did not appear to be lower when tannins and lignins were detected. On the 28 samples where tannins and lignins were detectable, the pH average was 7.06. This does not differ materially from the overall average pH of 7.03.

Tannins and Lignins Summary

Tannin and Lignin levels appear to be very low, with values commonly below the detection limit. Also, there appeared to be no connection between detectable tannin and lignin levels and lower pH values.

Overall Summary

Based on approximately 2 years of data involving 130 sample collections, pH does not appear to be unusually low in Trout Creek. The overall average pH from these samples was 7.03, with sites varying from an average pH of 6.96 to 7.13. In no cases was a pH level lower than 6.5 detected. Other parameters collected generally were indicative of a healthy stream system.

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Web site references

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EPA ref 2 Environmental Protection Agency, Monitoring and assessing water quality 5.4 temperature from web site http://www.epa.gov/volunteer/stream/vms54.html

US epa ref 3 Environmental Protection Agency, Monitoring and assessing water quality 5.2 dissolved oxygen from web site http://www.epa.gov/volunteer/stream/vms52.html

EPA ref 4 Environmental Protection Agency, Monitoring and assessing water quality 5.5 turbidity from web site http://www.epa.gov/volunteer/stream/vms55.html

EPA ref 5 Environmental Protection Agency, Monitoring and assessing water quality 5.9 conductivity from web site http://www.epa.gov/volunteer/stream/vms59.html

EPA ref 6 Environmental Protection Agency, Monitoring and assessing water quality 5.6 Phosphorus from web site http://www.epa.gov/volunteer/stream/vms56.html

EPA ref 7 Environmental Protection Agency, Monitoring and assessing water quality 5.7 Nitrates from web site http://www.epa.gov/volunteer/stream/vms57.html

USGS ref1 USGS Water resources (http://water.usgs.gov/monitoring_day/measurements.html)

Appendix B

Stand Examination and recommendations for Dave Jursik

Informal Stand Examination Report
David Jursik Property
Skamania County Tax Lot 503, T4N R7E Sec 15
October 29, 2003

On September 26 I looked at Dave Jursik's bank along the Wind River, reforestation success from spring 2003 planting, and did a brief examination of his Forest Land. All were done at the request of the landowner.

Owner's Objectives

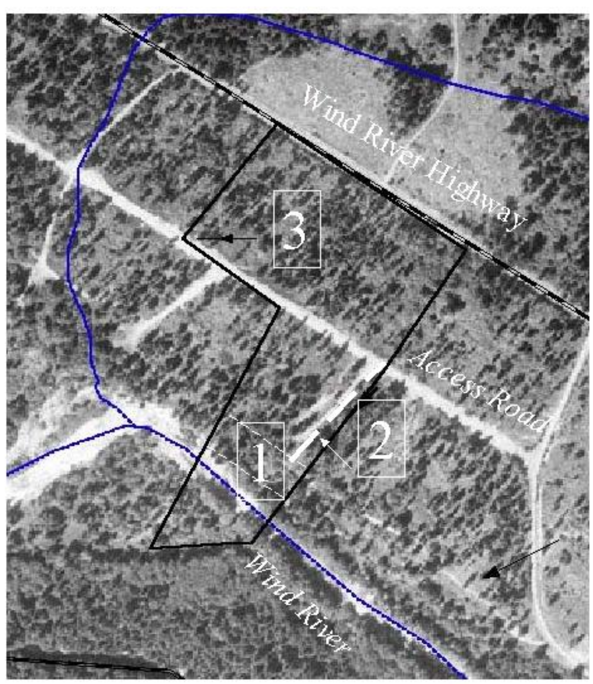
The landowner would like to maintain the property, and enhance wildlife values. He also would like to protect his streambank.

River Bank

A portion of the Wind River bank on the Jursik property consists of a steep cutbank. The river is eroding and undercutting this bank. Generally, this reach of the river appears to be bedrock-controlled, and does not move about on the floodplain like it does further upstream or downstream. There is a large amount of cobble on the western streambank, upstream from the cutbank (visible in the picture to the right) that probably forces the water against the cutbank.
I will look at this site with Engineer Paul Cleary on November 13 or on a later date (we have 3 sites to visit in Trout Lake on the 13th). Russ Lawrence is preparing a report from his 2002 survey of the Middle Wind. I have not yet seen the final report, but I don't recall mention of this reach in his draft report.

Forest Stands

The Jursik property consists of about 20 acres, most lying east of the Wind River. I did not visit the 3-4 acres that lie west of the river.
I roughly broke the property into 3 stands: (1) A narrow riparian bench, that parallels the Wind River; (2) a very narrow riparian area, along an unnamed intermittent stream that flows into the Wind River along the southeast side of the Jursik property; and (3) the main portion of the property, lying on a flat bench, stretching from about where the Jursik cabin lies, east and north to the Wind River highway.



Stand 1

This narrow strip along the Wind River has a dense stocking of young Douglas-fir, grand fir, red alder, and bigleaf maple, plus some large Douglas-fir, red alder, bigleaf maple and Oregon ash along the river. The more densely stocked area has about 450 trees per acre, averaging about 6.5 inches in diameter at breast height. Trees look healthy for the most part; some of the younger Douglas-fir are suppressed by shading from larger trees. Understory plants noted are snowberry, dwarf oregongrape, and inside-out plant. There are also some small openings, which have a developed shrub layer. One such opening I noted had bitter cherry in it, a species with good wildlife value. One possible treatment may be to thin some of the more dense areas of Douglas-fir, in order to bring more light into the stand, and encourage development of shrubs and understory vegetation. The County should be consulted regarding activities in the riparian area. Removal of some small Douglas-fir may provide the landowner with a supply of firewood.

Stand 2

This very small area is a riparian strip, bordering a small, intermittent stream just southeast of the Jursik driveway. Part of this area may be on the neighbor's land, I was not sure of the boundary. This small area contains Douglas-fir, western redcedar, black cottonwood, red alder, and bigleaf maple. Understory plants include vanillaleaf, swordfern, inside-out plant, snowberry, salal and mosses. The stream bottom is rocky. The vegetation may serve as a valuable filter for water entering the Wind River.

Stand 3

The main portion of the property lies on a large, flat bench above the Wind River, and extends from about the location of the landowner's cabin to the Wind River Highway. The stand has been harvested, and now consists of a light stocking of trees that are growing very well. There are about 20 trees per acre larger than 5 inches diameter, and approximately 150 smaller trees per acre. The larger trees are mostly Douglas-fir, averaging about 18 inches in diameter, about 90 feet tall. Small trees are mostly Douglas-fir, grand fir, or black cottonwood.

The logging resulted in increased light reaching the ground, and the shrub layer has flourished. California hazel, vine maple, and Oceanspray make up the main part of a thick, tall (up to 20 feet) shrub layer. Some disturbed areas include scotch broom, a noxious weed. The landowner has worked to eliminate this weed in parts of his property, with the help of the Underwood Conservation District and Northwest Service Academy. Smaller understory plants include bracken fern, inside-out plant, snowberry, trailing blackberry, dwarf oregongrape, and some red huckleberry. A bit of hairy manzanita grows along the road that parallels the Wind River highway.

About 300 Douglas-fir and western redcedar were planted along the landowner's road in the past two years. About half of those trees are still alive.

A consideration for this stand is to let it grow. The large, mature Douglas-fir have plenty of growing room, and are growing fast. Some of the small trees are growing up through the shrub layer, and will increase the conifer density in future years. Although the site is understocked with trees, the vigorous shrub layer would need to be controlled before planting more trees, which seems to be an expensive proposition. I also think a case could be made that the dense shrubs are keeping the scotch broom from increasing their occupancy on the property. From a wildlife standpoint, the property presents a good mix of forested patches and open, shrub patches, attractive to a diversity of birds and other wildlife. There are few snags or defective trees, so cavities for some birds and mammals are deficient.

There may be some value in creating more space around the cabin, in order to minimize the chance of losing the structure, in case of a wildfire. It would be valuable to have a cleared area for 30 feet around the building, to lessen the likelihood of losing the building in a wildfire. The property also has poor access for a fire truck. It appears that there is an old, abandoned driveway immediately northwest of the existing driveway. That might be developed into a loop driveway. I would consult with the local fire department to see how it looks to them. You might also consult with DNR; if you pay a DNR-fire protection assessment you may be eligible for some help clearing around your structures. There is more information at their web page, http://www.firewise.org/wa/.

Jim White
Underwood Conservation District. October 2003